ECOFRAM: Aquatic Risk Assessment

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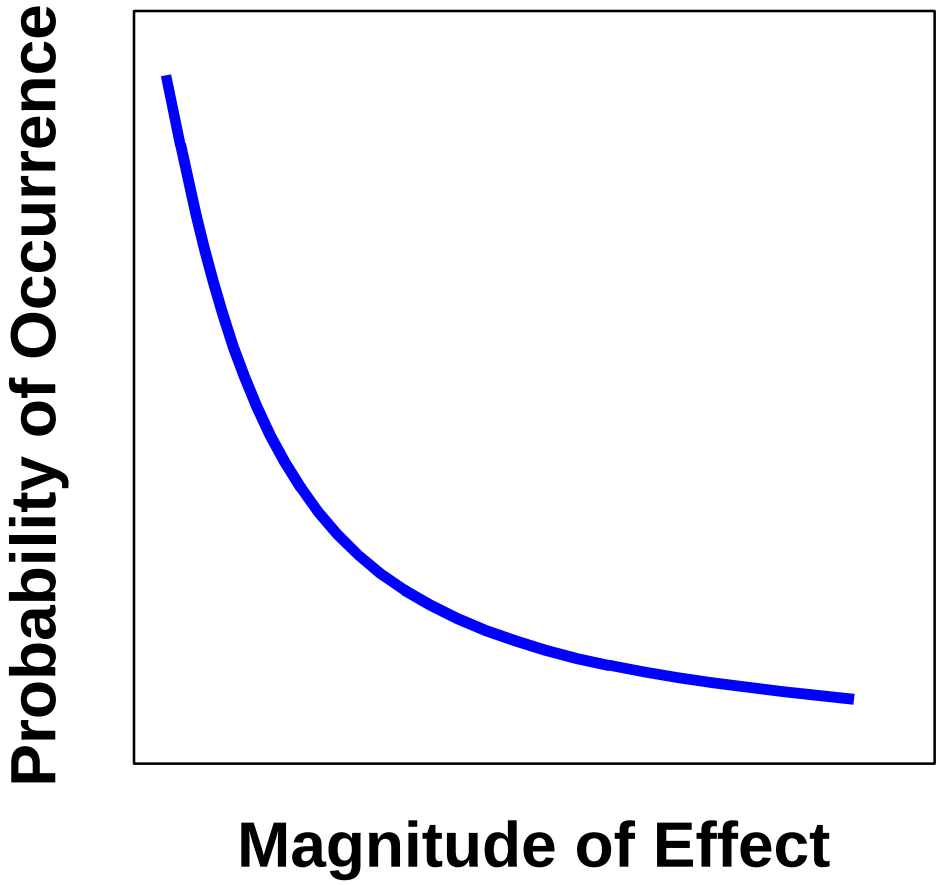
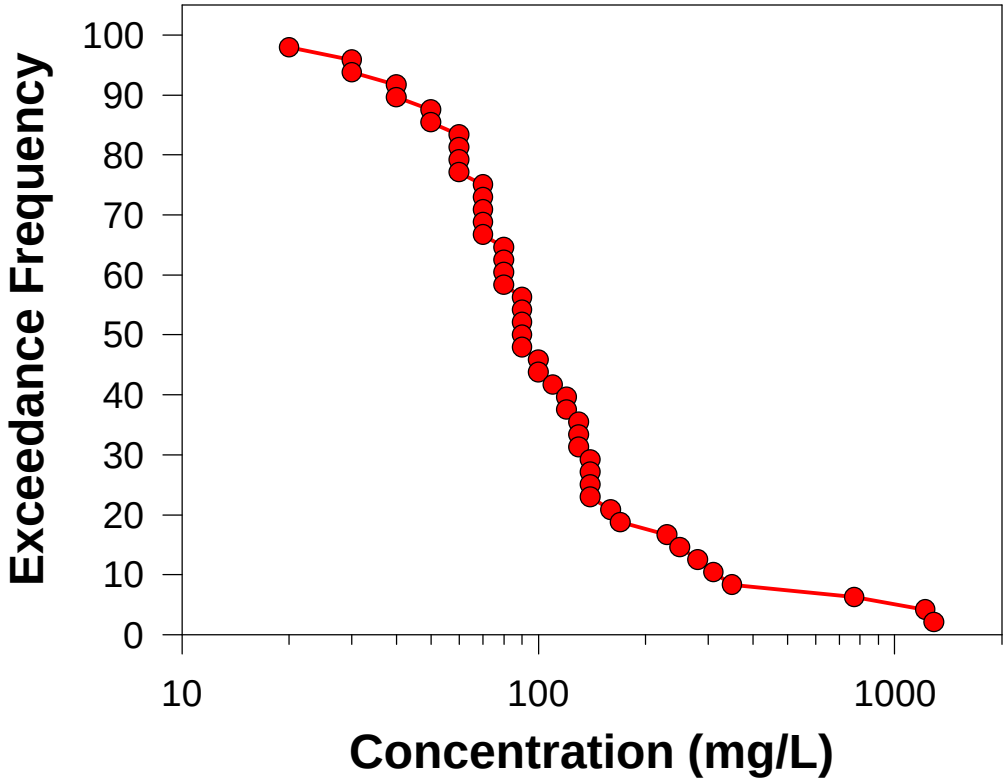
$$\text{Risk Quotient} = \frac{\text{Exposure Concentration}}{\text{Effect Concentration}}$$

Probabilistic Risk Characterization



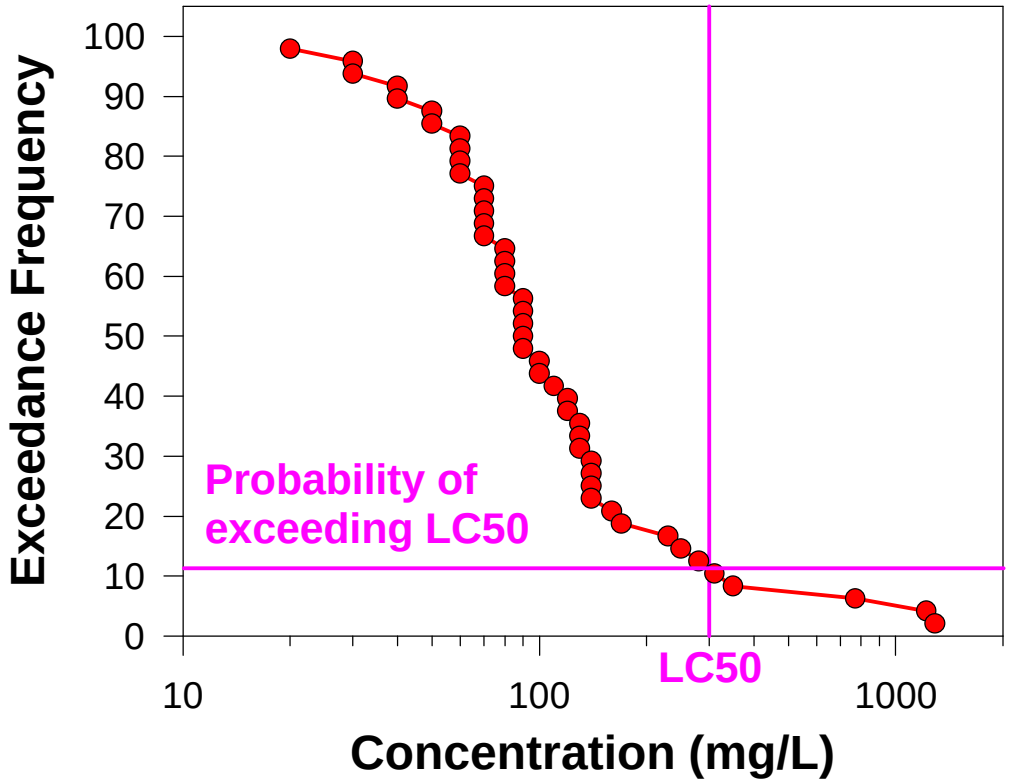
Exposure Distribution



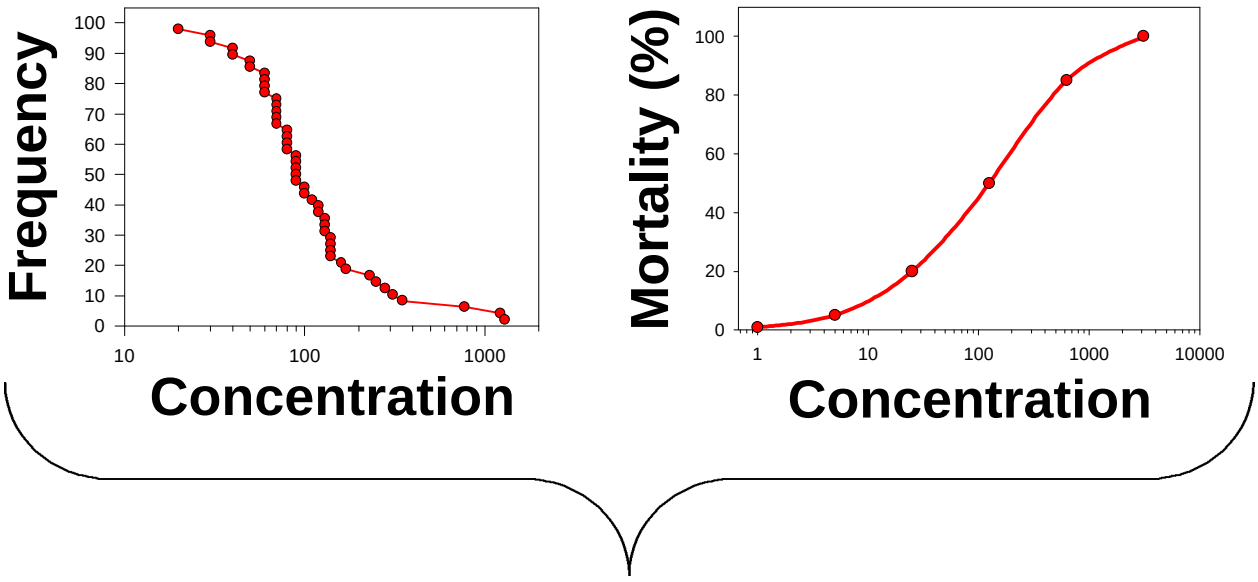
Exposure Analysis

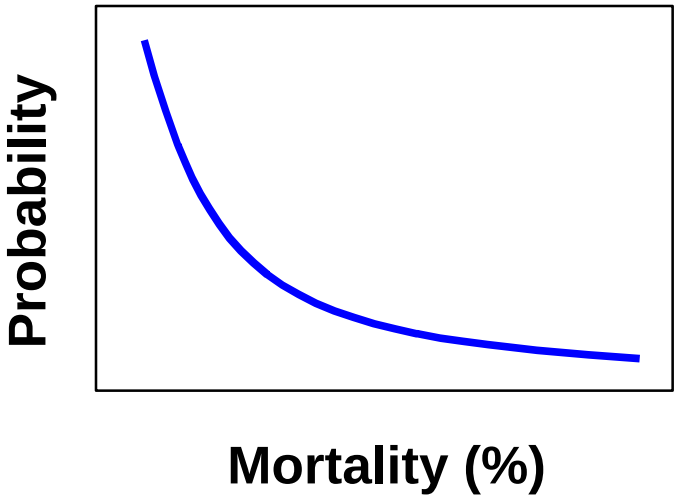
- Step 1: Deterministic; edge of field/pond, worst case (GENEEC)
- Step 2: Probabilistic; more chemical information; variation with weather, region, receiving water type (PRZM/EXAMS)
- Step 3: Probabilistic; landscape and watershed factors

Probability of Exceeding LC50

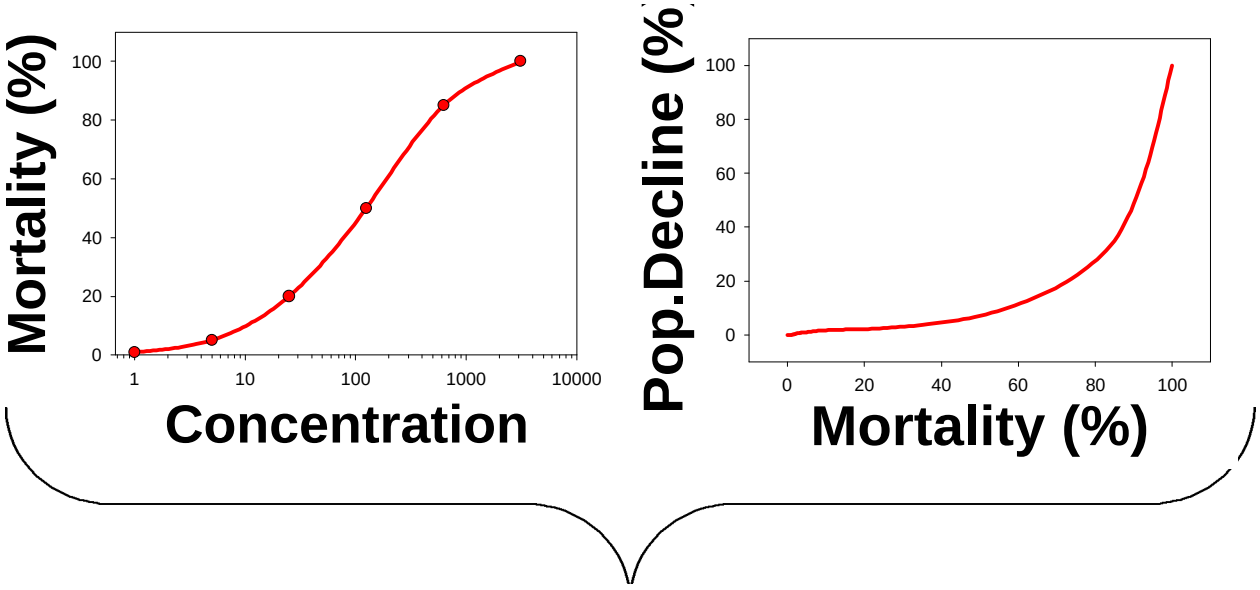


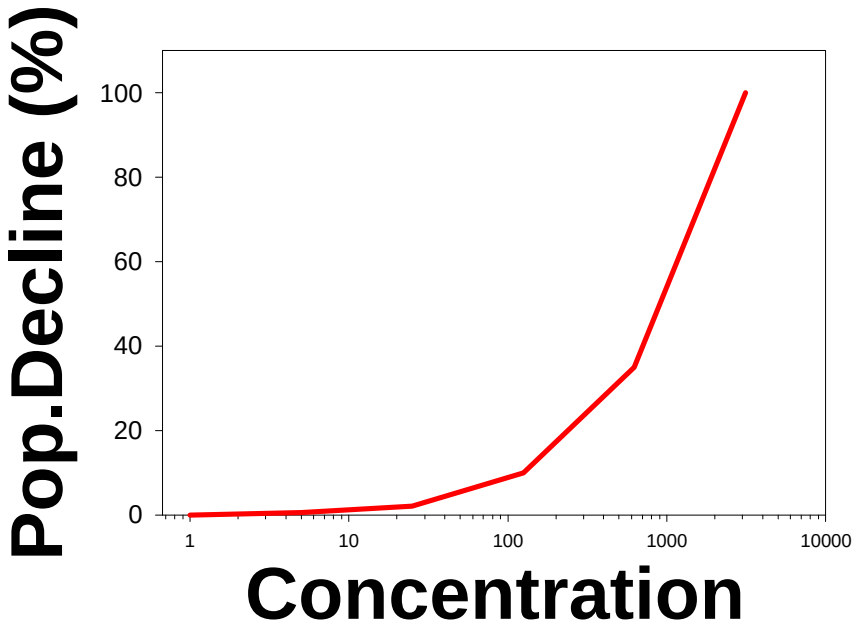
Probability of Mortality



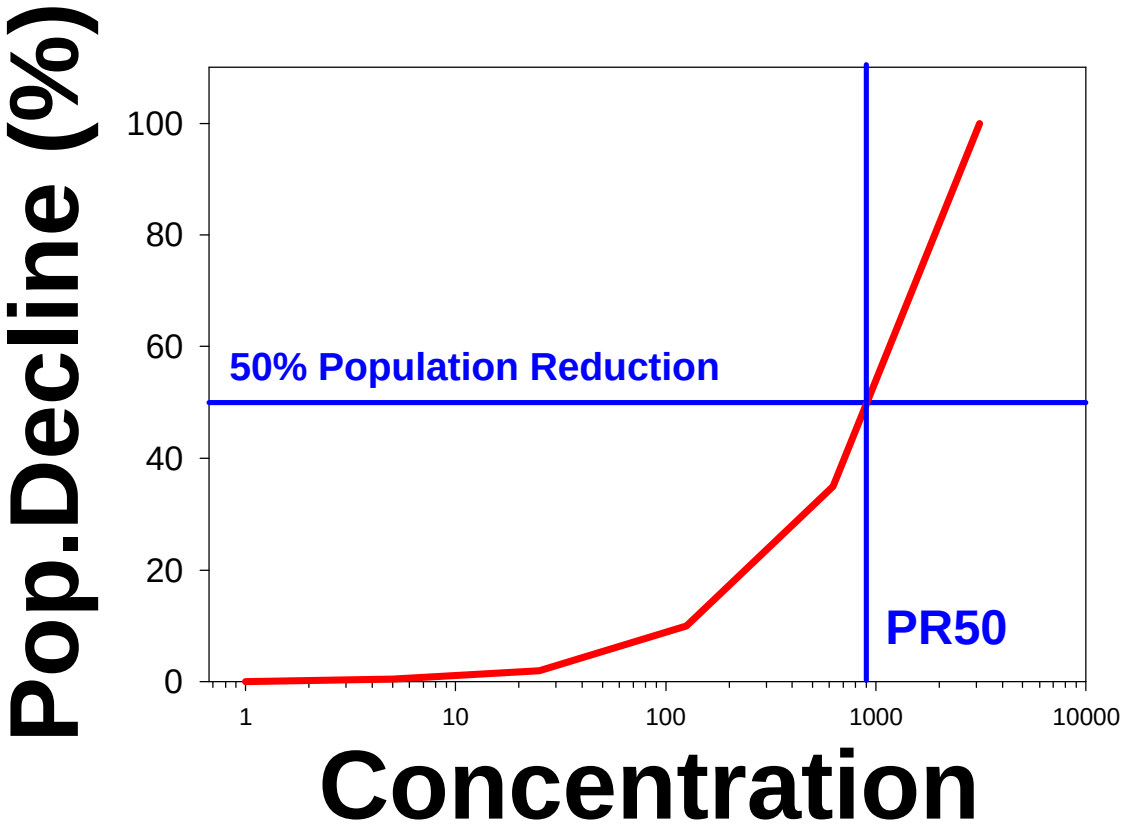


Extrapolation to Population Effect

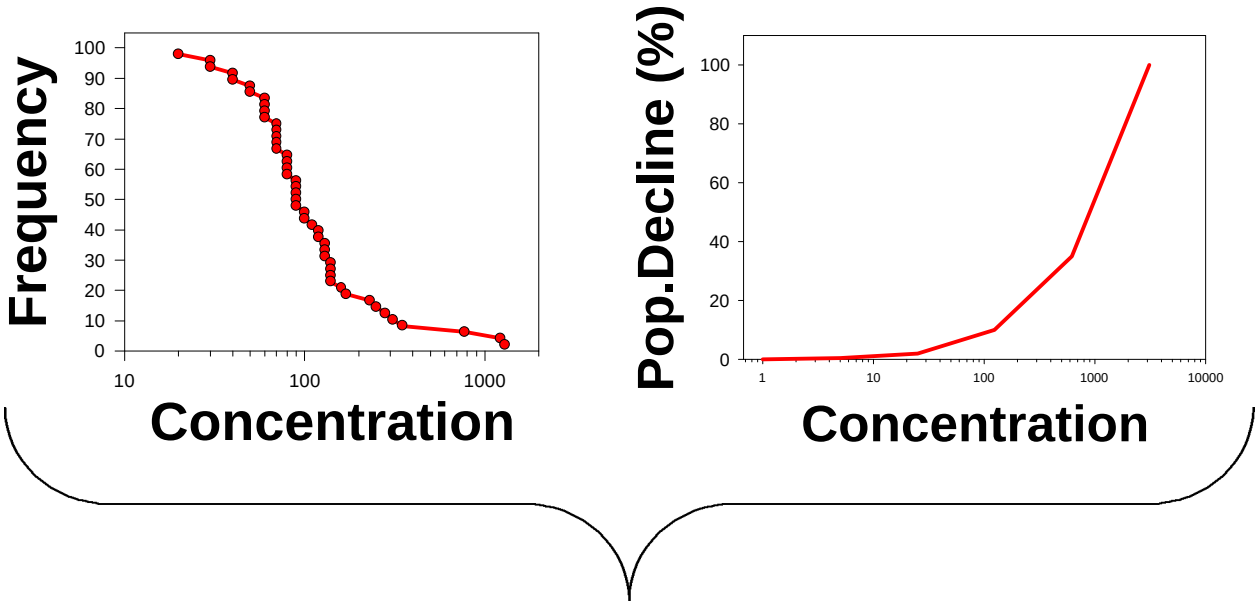


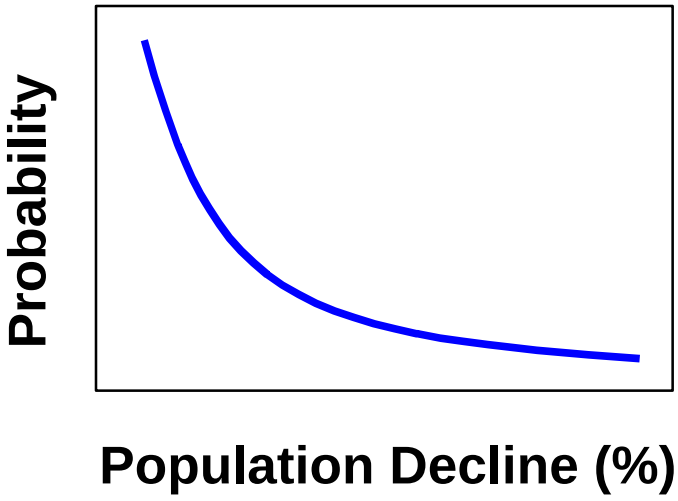


Another Endpoint: the PR50

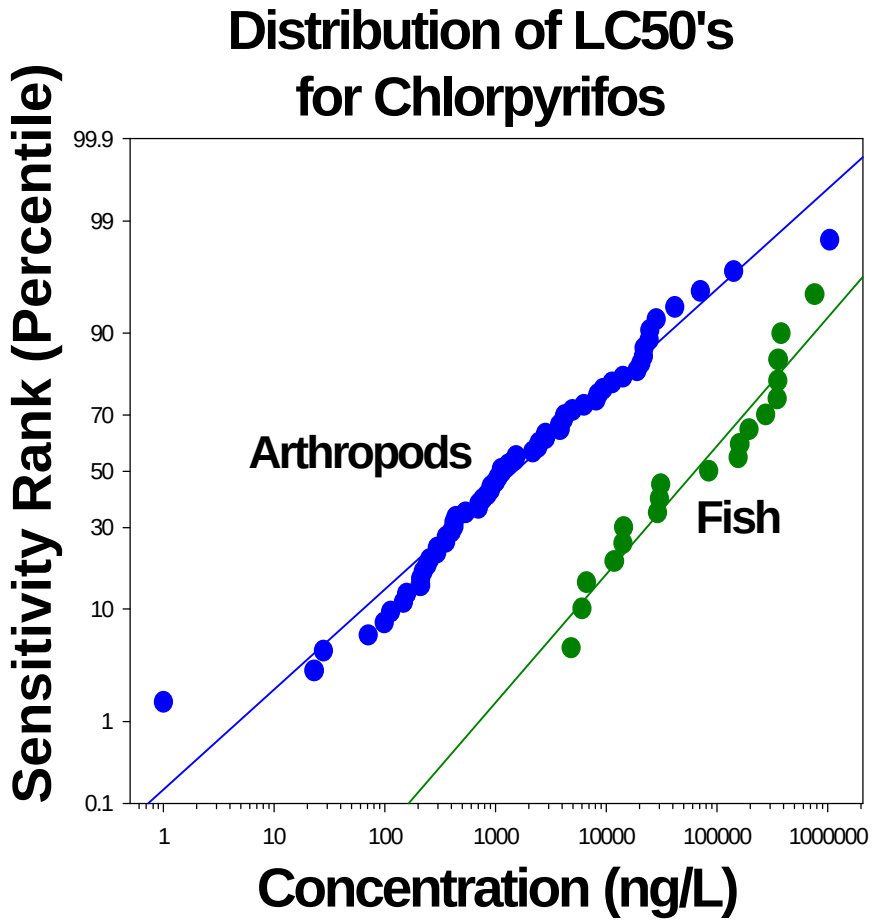


Probability of Population Decline

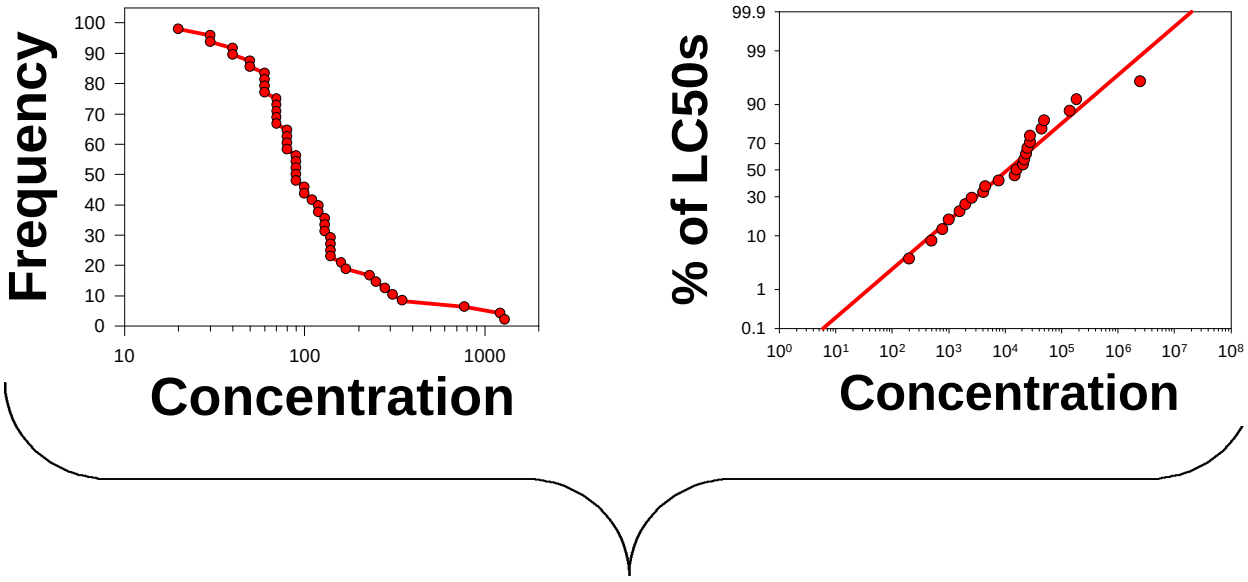


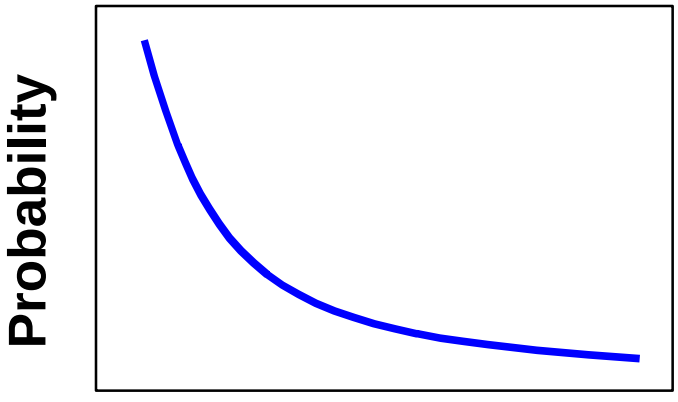


Distribution of Species Sensitivity



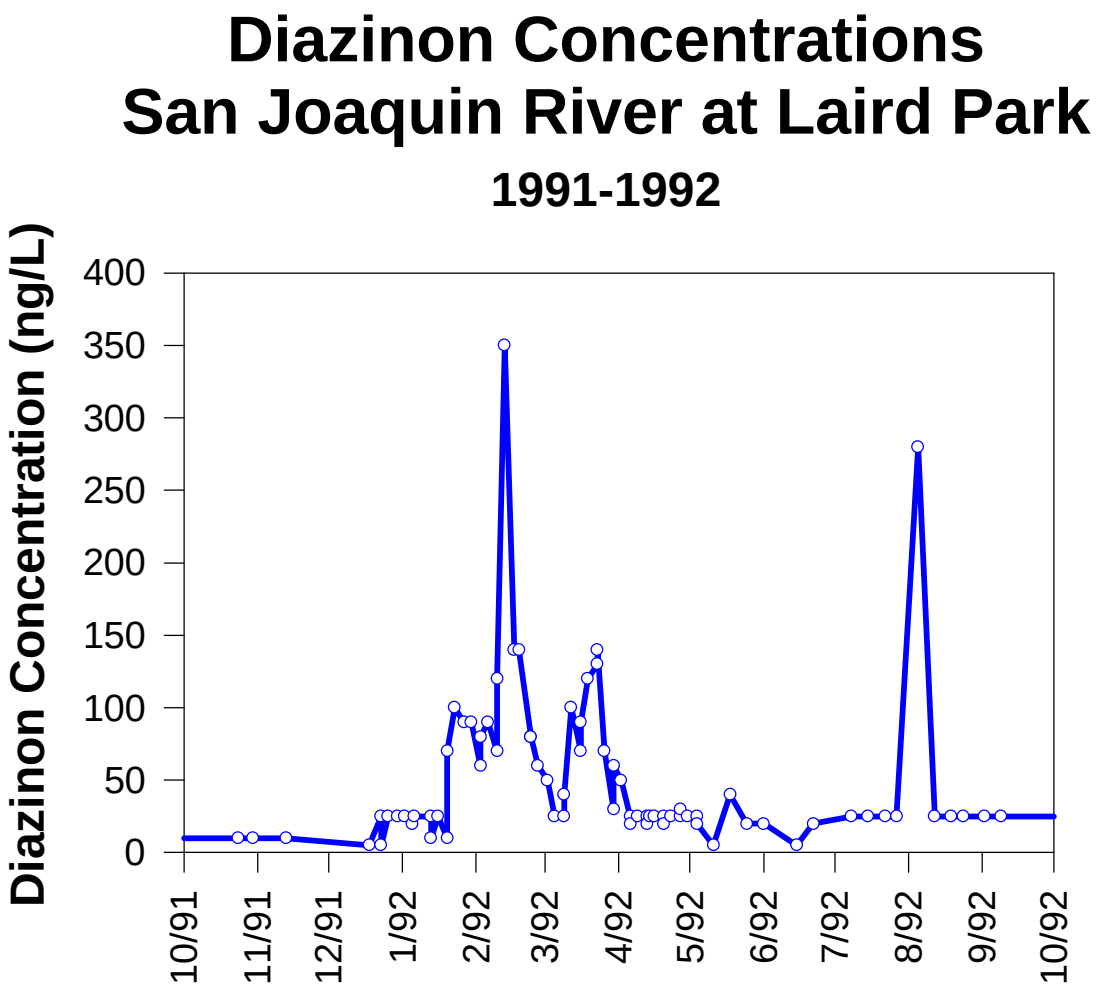
Probability of Affecting Species





Species Affected (%)

Pulsed Exposure



Assessing Effects of Pulsed Exposures

- Time-to-Event Analysis
- Laboratory toxicity tests simulating simplified pulses
- Uptake/depuration models linked to Critical Body Residue data

Other Components of Effects Analysis

- Chronic toxicity
- Reproductive effects
- Sediment exposure
- Behavioral endpoints

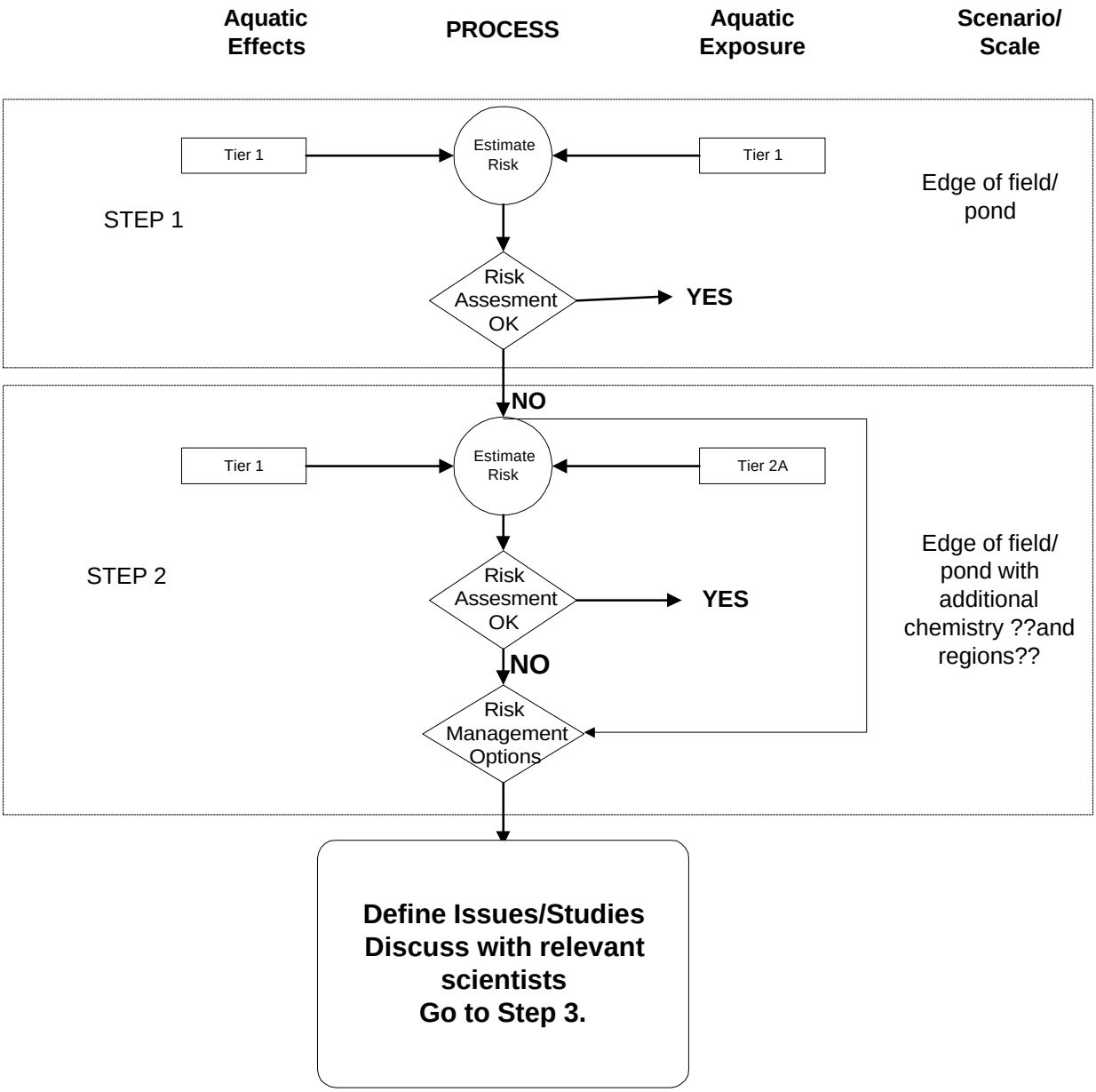
Outstanding Issues

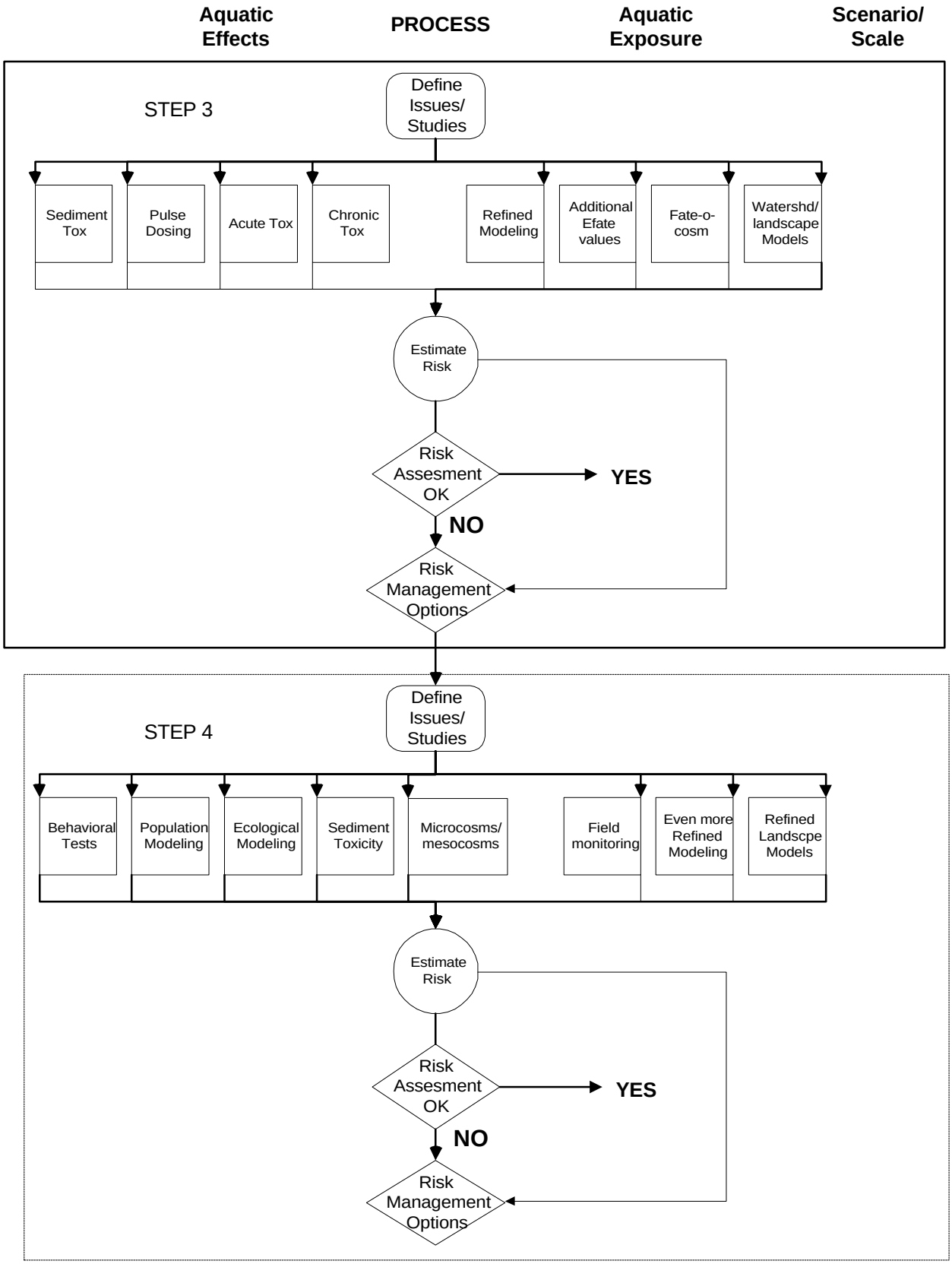
- Overall ecosystem damage
  - extrapolation from populations to ecosystems
  - microcosms and mesocosms provide insight
- Mixtures, multiple stressors

Summary of Tools for Effects Assessment

- Time-to-Event Analysis
- Pulsed Exposures
- Population Models
- Sensitivity Distributions
- Sediment Toxicity Evaluation
- Chronic Toxicity Tests
- Mesocosms and Microcosms
- Behavioral Toxicity Tests

Risk Assessment Process




Aquatic Effects
PROCESS
Aquatic Exposure
Scenario/ Scale
STEP 3
Define Issues/ Studies
Sediment Tox
Pulse Dosing
Acute Tox
Chronic Tox
Refined Modeling
Additional Efate values
Fate-o-cosm
Watershd/ landscape Models
Estimate Risk
Risk Assesment OK
YES
NO
Risk Management Options
STEP 4
Define Issues/ Studies
Behavioral Tests
Population Modeling
Ecological Modeling
Sediment Toxicity
Microcosms/ mesocosms
Field monitoring
Even more Refined Modeling
Refined Landscpe Models
Estimate Risk
Risk Assesment OK
YES
NO
Risk Management Options